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Abstract

This paper reviews the literature on the use of IT investment appraisal techniques in industry, and investigates the application of IT investment appraisal techniques in industry through a case study. Evidence from the case study suggests that financial limitations will restrict the IT department from employing IT personnel capable of performing the IT evaluation necessary. Furthermore, the study shows that the organisation will limit its IT evaluation effort as the result of the way in which its uses system. Finally, the case study shows that the unavailability of an organisational methodology to conduct IT evaluations will restrict the evaluation effort by the IT department. Other factors are also presented and analyzed.

Keywords: IT evaluation; IT investment appraisal technique; decision-making; case study

Introduction

Research in the area of Information Technology Evaluation (ITE) has detected a clear trend in industry during the last decade; reports indicate that decision makers are biased towards simple quantitative ITE methods over complex quantitative or qualitative ITE methods (Deitz 1994; Computer Finance 1998; Ballantine and Stray 1998). Furthermore, it has been reported that decision makers often ignore ITE, preferring to rely on an *act of faith* and *gut feel* type of practice to invest in new information systems (Farbey *et al*. 1993; Small and Chen 1995). Exclusion of an IT investment appraisal technique will increase the risk that the evaluation will not uncover all the *hidden* costs and *softer* benefits, driving the overall IT budget to increase; perhaps up to four times the initial investment (Hochstrasser 1992). It has also been suggested that simple quantitative IT investment appraisal techniques are not capable of assessing modern strategic systems (Kaye *et al*. 1995), causing benefits to go unmanaged which results in the system not achieving its full potential (Pennington and Wheeler 1998).

Research aimed at supporting ITE is expected to continue for a number of reasons. First, the information technology industry continues to grow. IDC research estimates an increase between 1995 and 1997 in the IT global market from $530 billion to $1.8 trillion and forecasts a 10% global increase in growth between 1996 and 2000 (Willcocks and Lester 1999). Second, financial resources available for IT executives are scarcer, as a result of competition among different departments for capital (Remenyi 1995). In 1998, a survey of IT executives and CIOs at Fortune 500 companies reported that 75% of them would not change their budgets as a result of economic conditions and/or market turmoil (Business Wire 1998). Finally, ITE research will continue because reports on IT failure are still coming in. The highly publicized failure of the London Stock Exchange on 5 April 2000 is but the latest example of IT failure (Reuters 2000). Interest in ITE is reflected in the extensive literature including, among others, Kauffman and Weill (1989), Willcocks (1992), Farbey *et al. (*1993), McKeen and Smith (1993) and Hitt and Brynjolfsson (1994). Powell (1992), Farbey *et al.* (1993), Willcocks (1994) and Avgerou (1995) list taxonomies of IT evaluation methods.

Although the use of IT investment appraisal techniques in industry has been extensively studied and documented, little or no research attempts to explain *why* some methods are preferred over others. This paper aims to address this by way of case study research, which is now described.

Case Study

To conduct the case study, an interview agenda was developed. Divided into five parts, and with all sections being qualitative in nature. Collected data by interviewing at least three staff members of the organisation, reviewing archive documents, and minutes of meetings. The questions aim to address the following:

- To establish general company information
- To establish the decision making structure in the organisation
- To establish the decision making structure in the IT department
- To investigate which IT evaluation method was used, and how was it selected
- To establish the overriding factor(s) for choosing/ excluding IT evaluation methods

Organisational Context

The organisation under study is a local UK Authority, established in 1996 as the result of the merger of two districts and two counties. The merger took place due to a region wide directive by the regional government to reorganise the geographical borders and functionality of all its districts and counties. The Authority provides approximately 120,000 customers with a large variety of services in the areas of housing, environment, education, highways, social services, and tourism and employs approximately 5,500 staff members. Merging the two district and two county authorities into a single authority meant that the different IT systems, in different departments, using different platforms would need to be harmonised. Each of the old four Authorities had 20 to 25 departments, and each department had one or more IT systems to support its business process. Effectively, the merger required the new IT department to do a department-by-department merger of four different IT operations. This also applied to the IT department itself, which was overseeing the IT merger process. During reorganisation stage in 1995, the newly appointed Chief Information Systems Officer (CISO) formed a project group of IT professionals and key users to investigate the appropriateness of keeping or discarding the old IT systems. This initial justification process had a general set of criteria, which was developed by the CISO and top management, and applied systematically to each department. The criteria are listed and described in Table 1.

Table 1. Criteria for Implementing New Systems

Criteria	Discretion
Functionally	IT systems must accommodate the job requirements of current and future organisational needs
Technologically	Specifications of hardware and software must fit with the organisational technology strategy [a]
Cost	Initial and ongoing costs of the IT system need to be within allocated budget. Contractual lease agreements on hardware and software must also be taken into account
Data capacity	Storage capacity of new system must to be large enough to accommodate data from all four merged organisations
Data protection	Data migrating from old systems to new ones need to be protected from loss as the result of the transfer
User opinion	The majority of users trained to use a particular system will have a stronger say on which system to finally implement
User training	Systems with large number of users will cost less in terms of training

[a] The actual IT strategy of the organisation is confidential, but includes primary issues such as not implementing technology that does not fit with current organisational technology, general issues such as taking advantage of new technology to improve the business process, and specific issues such as using Windows 95 as a standard operating system.

The entire organisation had approximately 12 months to prepare for reorganisation, requiring all departments to be ready to start under the umbrella of the new Authority by 1 April 1996. As noted above, the new Authority is made up of two districts and two counties, all with different operating procedures that needed to be standardised, different organisational structures that needed to be reformulated to fit current and future needs, and different technology platforms that needed to be harmonised. Therefore, the IT department had to apply the criteria in table 1 on approximately 240 different systems.

Information gathered by way of the case study showed that the IT department decided to use several platforms, putting first the functionality and cost requirements over the need to completely harmonise systems. Furthermore, users participated in choosing the technology, as the IT department was keen to give proper consideration to the social aspects of the system, such as user

resistance to new technology, user technology preference, the effect of the IT on current job discretion, and user training. The position of the IT department during the reorganisation process can be summed up in the following statement:

> *'We felt that we would be unable to successfully implement the system without the full support of the users, who would ultimately use the system'* CISO

Different platforms were also chosen due to the unique characteristics of individual departmental systems, requiring different programs to support the business process, which ultimately meant different platforms. Furthermore, most inherited systems were difficult to replace, as they were cross-interfaced with other systems to allow them to transmit data back and forth. To remove them meant the rewriting of codes, a process decided (by CISO and working group) not to be feasible at that point in the reorganisation effort. The process of selecting the systems that would be used, and those that would be disregarded ultimately resulted in three brand new systems Forward Planning department, Finance and Recourse department, and Housing department) and approximately 57 inherited systems ready to start by 1 April 1996.

System(s) Operation

The current IT department has 34 IT specialists, whose role is to service, support and manage approximately 1500 organisational PC users in 22 departments across 59 locations. The IT department supplies the organisation with a range of IT services (Such as systems softwere mantenance, trafic monitoring, and hardwere and softwere procurment), and is responsible for the overall IT strategy and technical direction. The strategy is constructed in conjunction with the IT Client Group, consisting of senior management from user departments. The functionality of IT systems can be split into two categories. The first category has four systems that are used by all the departments in the organisation to *support* (as defined by Farbey *et al*., 1993) their business process. They are:

1. General Ledger system: was inherited in 1995 from one of the four merged Authorities, is used by the financial departments of the organisation for accounting purposes. The software costs of this system are paid for by the Accountancy Manager, and the IT department pays for hardware and network costs.

2. Credits and Payment system: was also inherited in 1995 from one of the four merged Authorities, is used for receiving income. Accountancy Manager, and the IT department have a similar arrangement to that of the General Ledger system.

3. Council Tax System: also inherited in 1995, used to send out bills, as well as to act as a debt collector, chasing due fees. Accountancy Manager and the IT department have a similar arrangement to that of the General Ledger system.

4. Geographical Information System: implemented in 1997, is located in the Forward Planning department, and is used for mapping purposes. The software costs of this system are paid for by the Forward Planning department, and the IT department pays for hardware and network costs.

The other category includes approximately 57 different systems providing information that make the management process possible. The case study showed that these systems are not used across departments, but operate in isolation to *support* specific requirements of departmental business processes. Individual, rather than corporate decision making, tight resources, and operational costs dictate that each department run their system(s) without sharing functionality. Consequently, the utilisation, upgrades, modifications, and up-keep of these systems are the responsibility of the respective department. They are, however, maintained by the IT department, which also offers limited training to system users, as well as procurement all new hardware/software.

IT Investment Decision Making

Individual, rather than corporate decision making made it difficult to develop, but more importantly, to maintain, an organisation wide IT strategy. One example resulting from this lack of agreement is the application of spreadsheet software. The organisational IT strategy dictates the use of Lotus software, however it is not uncommon to see Excel software used. Without the authority to enforce such a basic element in the strategy, the IT department finds it difficult to enforce more fundamental aspects of the strategy such as user training before a new system is implemented, a responsibility typically assigned to the department in question. Consequently, lack of user training often forces IT staff to get involved in solving routine technical problems, such as password error and the retrieval of lost files. The knock-on effect is that IT staff resources are pushed beyond their limits.

The negative effect of individual rather than corporate decision making also factors into the inability of the IT department to create and enforce an IT investment decision making methodology at an organisational level. One attribute of this situation is the lack of involvement from organisational directors in the formulation of the IT strategy, leaving the task to the assistant director level, or even on a lower decision making level. In effect, IT investment decision making strategy is redeveloped in each department, rendering the organisational IT strategy to some extent ineffective. Lack of an organisational IT strategy gives departments complete control if they do not which to spend departmental funds on new IT investments. However, when the procurement of a new system is required, the CISO forms a team consisting of IT specialists and key users. On the one hand, technology and the alignment with strategy is the responsibility of the IT department. On the other hand, functionality, and alignment with the business process, is the responsibility of the users. The concept of the IT project either initiates from within a department, or by way of suggestion from a member of the IT department. What follows is a meeting between key members of the department in question and staff from IT department. In that meeting, the IT department staff attempt to establish the proposed IT investment requirements in terms of functionality. The IT department then send invitations to a company(s) to submit an offer, that detail technical specifications and projected costs of the new IT system. Afterwards, the IT department selects offers on the basis of the criteria in table 1 (functionality, technology, cost, etcetera.). Next, the IT department prepares a feasibility report for the department in question based on the offer from the selected company. Finally, the report is submitted for the approval of the CISO and the senior user who ultimately pass their final recommendations to the board of directors.

Although all procurements need to be approved by the IT department (but not the decision to invest in the first place), this process only takes place for acquisitions greater than £1000 sterling. The interviewees noted that key users or IT officers that recognise the weakness in the system often drive new IT projects. In addition, the Client Group meets with the IT department on a quarterly basis to discuss the IT strategy, and new procurements. All decisions with major impact on the functionality on departmental, or organisational IT systems are finally discussed and approved, or discarded, at the board of director level. However, the board of directors does not have the final say on IT projects not included in their devolved budgets, or on IT projects costing more than £15,000 sterling. For such capital investments, a purchase request form is filled out by the IT department and the IT project department, bringing a bid for capital request to the elected member level for their final approval (corporately they represent the shareholders of the organisation). These 60 elected members then have the ability to allocate the required funds from the organisational capital fund reserved for such capital investments. The other option available for departments wishing to make capital investments is to submit a bid for revenue to the elected members in the devolved budget in the next budget cycle.

Systems are typically replaced, modified, or purchased for one of two reasons. First, if the current system is no longer appropriate as the result of functionality problems, technical specifications, government regulations, or if the business process has changed. Second, if the department has no IT system and intends to invest in technology to improve the efficiency and effectiveness of the new department. The organisation looks at cost, functionality, alignment with business process, opinion of users, and compatibility with current technology as criteria for all new procurements. Three examples of recent IT projects are presented below:

1. **Planning System:** In 1997 the paper-based system in the Forward Planning department was not delivering (from a senior user perspective) in terms of management, time, process, documentation, and efficiency. The director of the planning department requested the IT department to recommend a system that would improve the department's business process. The IT department decided not to develop the system in-house due to staff limitations and time constrains imposed by the planning department. For such a request, the IT department has a standing criteria to make certain that the recommended system would fit cost requirements, technical specifications, corporate strategy, and would get positive response from users. The planning system is used to provide housing/extension houses with permits.

2. **Education System:** In 1998, there was recognition within the Education department that the paper-based system was not efficient, causing staff to waste time on both retrieving and managing documents. As before, the IT department was contacted by the Education department to recommend a system that would greatly improve its business process. The IT department followed the same criteria as those for the Planning system. The Education system was implemented to support the capture and management of data concerning student grants, student loans, student records, and teacher records.

3. **Document Imaging Processing System (DIP):** In 1999, new office accommodation was in heavy demand, pushing the organisation to consider alternative solutions to solve this problem. One of the solutions was to implement a document imaging system. It would be used to convert rooms of paper-based archives to a digital form, which would free these rooms. In response to this idea generated by employees, the IT department presented a feasibility report that looked at the cost of implementing the DIP with regard to the potential savings from the extra office space, improved document management, elimination of paper-based archive maintenance costs, and savings on staff not retrieving paper documents. Fit with existing systems, user opinion, and organisational strategy were given consideration when developing the system.

IT Evaluation

The IT department performs technical evaluation of how the system functions, via IT indicators. *IT indicators* include systems availability, response times, transaction processing times, and network traffic. In 1996, the CISO started this program to responds to users complaining about downtime. IT indicators would be used the IT department to defend the quality of its service. This technical evaluation is concerned more with the technical performance of the system than the performance of the system to deliver benefits at the desired costs.

In 1998 The IT department started participating in a *benchmarking* club that compares organisational IT indicators with IT indicators of 12 other UK Authorities. This benchmarking club is the result of the Best Value (BV) initiative, which aims to achieve the right service for the right cost. BV was recently introduced by central government, and has many components that are relevant to the IT department, including evaluating, benchmarking and service delivery performance. This gives IT evaluation a new importance in all UK local Authorities. The 12 Authorities in the benchmarking club were selected by the organisation used in the case study due to similarities of functionality and clientele. In 1998/1999 results form the benchmarking club showed that the organisational IT costs were 25% above the average, even though the overall organisational running cost was only 1.3% above average. The benchmarking activity also demonstrated that the Authority has a total net cost of 11.2% below average. The organisation applied the results of the benchmarking practice to measure the performance and efficiency of the IT department. Therefore, the last figure is especially important as the organisation which participated in the case study used the results to conclude that it was within acceptable financial parameters.

The IT department also performs a number of activities that are considered partially driven for the purpose of IT evaluation. For example, the IT department annually sends out a *survey* to its users to assess the performance of the IT department. The survey asks:

1. hether the IT department meets the client expectations on problem resolution;
2. Whether the system provided meets the functionality needs of the department;
3. Whether the network response time is adequate; and,
4. If the support from the company that the system was bought from is appropriate.

User input is also sought by the IT department during the *quarterly meetings* with the Client Group, on the successfulness of the IT system in terms of its ability to support the business process. The IT department pursues this activity until a consensus view is achieved with the Client Group. Also, a service level agreement (SLA) was introduced in 1997 into all departments of the organisation by the IT department. They are formal documents, which give in detail the standards, and targets that the client can expect from the IT department. However, the SLA does not specify penalties on the IT department if it fails to meet the standards and targets. For example, SLA specifies the response time for an inquiry (5 minutes) but does not specify resolution time. Furthermore, the SLA does not have a signing-off procedure once the service is completed. SLA is negotiated annually and SLA meeting occur on a quarterly basis with senior department members.

Further Case Study Analysis

The case study provided insight into the organisational practice of selecting IT investment appraisal techniques, and the factors that motivated that selection process. By looking at the history of the IT department, it was clear that IT evaluation was not a priority during the reorganisation period (*Factor 1*). Rather than identifying, and applying IT investment appraisal techniques to sort out which systems would remain and which systems would be replaced, priority was focussed on the task of harmonising IT systems, allocating staff, patching up technical defaults, and setting systems up to support department's business processes. Interviewees commented about the reactive nature of the organisation, always dealing with the symptom, rather than the actual cause of disease. It might therefore be said that organisation as a whole operates more in the sense of fire fighting, rather than problem prevention (*Factor 2*). For example the benchmarking club was forced on the organisation, and consequently may not be considered as a proactive move by the organisation to evaluative its IT system. That is to say, this organisation would not have participated in such an activity if it did not have to. Therefore, evidence form the case study has demonstrated that such a reactive organisation has little or no interest in performing IT evaluation, or using any investment appraisal techniques, unless a higher government authority demands or enforces it. Since then, departments procured add-on systems (higher performance hardware, newer software versions, and additional network) aimed at improving the efficiency and effectiveness of specific departments. These add-on systems were not formally evaluated (from the IT perspective) but were justified by departmental managers as rational investment, since they signified improvement to the organisation (*Factor 3*).

The case study also demonstrates that it was common practice to invest in a system, or add to a current system, if the department had extra funds at the end of the budget cycle. Departments would typically do this to avoid returning the extra funds from the dissolved budget to the main organisational fund, and risk reducing their dissolved budget during the next cycle (*Factor 4*). This meant that such IT investments are not initiated to improving business performance, not for ginning competitive advantage, but to protect the budget form reduction. Consequently, IT investment appraisal techniques have no role here but to justify a decision that has already been taken. Such projects content to choose hardware, software, or networks that best fit user functionality requirements within the budget available for the department. The employment of an accounting type feasibility report that targets initial costs is not uncommon here. Such reports may also include technology specifications and projected benefits to the department. Although such feasibility reports resemble IT cost benefit analysis (Farbey *et al*., 1993), they do lack its detailed analysis, and its purpose (to actually explore if the system is suitable). Furthermore, contractors supplying the system are also evaluated for their reliability to maintain the system and train/support employees during the life cycle of the system. Coupled with the feasibility report, the IT department is confidant that sufficient evaluation was conducted, reducing the opportunity for an IT evaluation project to occur (*Factor 5).* During the investigation, interviews also commented that the Y2K problem was used in the organisation to push for IT modifications and procurements of new systems, above what was actually required to comply with Y2K needs. The availability of organisational funds in this particular situation gave room for extra spending on IT; further indicating that fund is a factor in applying an IT investment appraisal technique. More importantly, IT investments that resulted from the Y2K problem demonstrated a lack in IT competence on the level of top management (*Factor 6*).

The interviewees noted that lack of organisational funds, was (and still is) a primary factor for not conducting formal IT evaluation when investing in new projects (*Factor 7*). The reasoning here is that lack of funds prohibited the employment of qualified IT personnel to conduct the evaluations process. The investigation showed that the annual budget had not allocated funds specifically for IT evaluation projects. Furthermore, the budget of the IT department (£2.5m in 1999) was decreasing over the last three years due to an initiative by top management to lower the budget by 10% in all departments, further adding weight to factor 6. One of the main issues that was continually raised as a factor for not applying IT evaluation was (and still is) the unavailability of organisational rules and regulations that support the use of any IT investment appraisal techniques (*Factor 8*). The CISO stated that his job required IT investment decision making, which was mostly performed using logical reasoning, or at best used a financial feasibility report. In this case, idiosyncrasies associated with organisational decision making prohibited the use of IT investment appraisal techniques because it did not provide an evaluation methodology. Interviewees stated that such a methodology could not be developed since every new project has a different set of variables, and that it would not be plausible to adopt an IT investment appraisal technique that would fit all situations. The unavailability of a methodology also adds to the political inability of the IT department to commit users to the evaluation process (*Factor 9*). In other words, the IT department does not have organisational rules and regulations to make available/secure the participation of key users in the IT evaluation project.

It is also apparent from the case study that political barriers between departments complicated IT evaluation, preventing the application of an investment appraisal technique of an organisational level. Sections 2.3 and 2.4 of the paper discuss this issue in detail and attributes departmental, rather than corporate decision making (*Factor 10*). A side effect of this decision making culture is the duplication of IT staff service across systems working in isolation, further limiting the resources of the IT department, and its ability to practice IT evaluation. The final, and perhaps most obvious, reason given by the interviewees for not conducting an IT evaluation is that it was not required from the IT department (*Factor 11*).

The case study was not able to establish if the functionality of the system was a factor for excluding certain IT investment appraisal techniques that required the absolute attribution of IT costs and benefits to their original contributors. However, interviewees commented the ledger system, which is cross-used in the organisation, would present a challenging task if it were evaluated. The summary of the factors are presented in table 2

Conclusions

There is strong evidence in the published literature to support the view that *financial constraints, functionality of the IT system, and organisational investment decision making* affect the IT evaluation method selection process. Original case study research carried out by the authors of this paper show the plausibility of such factors within the organisation under investigation. The case study demonstrates that cost was always a factor prohibiting the proper application of an IT evaluation process. The reason for this is that it restricted the employment of IT personnel capable of carrying out such a process. The case study also shows that a proper IT evaluation was not possible because the organisation has a number of complex systems operating in isolation, and in a situation where clear lines between their costs and benefits cannot be established. Finally, the study demonstrates that the unavailability of a decision-making methodology prohibited the accommodation of a formal IT evaluation project.

Table 2. Summary of Factors Restricting the Use of IT Evaluation

	Factor		Factor
1	IT evaluation was not considered a priority during reorganisation	7	Lack of organisational funds to finance an IT evaluation project
	Fire fighting, rather than problem prevention makes IT evaluation an option rather than a necessity for such a reactive organisation		Unavailability of organisational rules and regulations that support the use of any IT investment appraisal techniques
3	Add-on systems are justified as rational investment as they signify improvement to the business	9	Political inability of the IT department to commit users to the evaluation process
4	Spend extra funds to the prevent reduction of departmental budget	10	Departmental, rather than corporate decision making
5	Contractors evaluation, and feasibility report were viewed as sufficient to go ahead with decision	11	IT evaluation was not required from the IT department by the organisation
6	Lack in IT competence on the level of top management		

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